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Pappu

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(54) **CARDIAC STIMULATING APPARATUS HAVING A BLOOD CLOT FILTER AND ATRIAL PACER**

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(52) **U.S. Cl.** **607/9**; 607/122
(58) **Field of Search** 607/5, 9, 119, 607/122–128; 606/200

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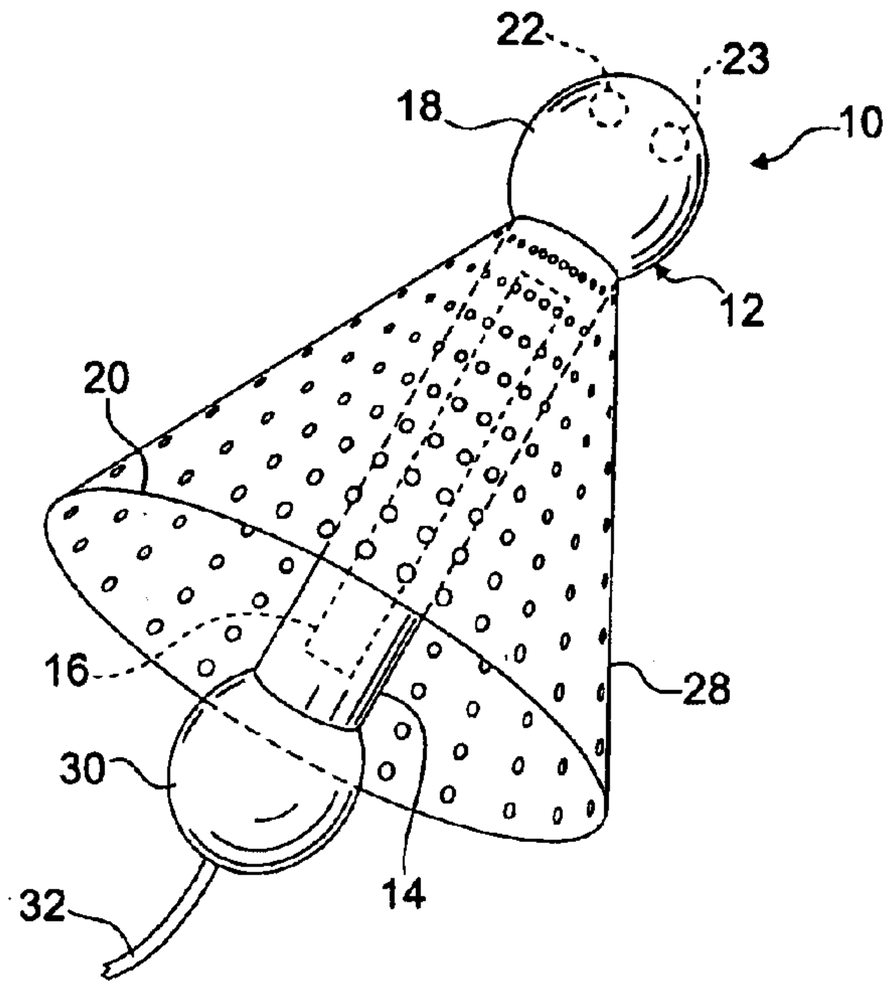
(57) **ABSTRACT**

An apparatus is provided for reducing the formation and migration of blood clots from an atrial appendage, such as the left atrial appendage, to the blood vessel system of a patient. The apparatus comprises an atrial pacer to treat non-rheumatic atrial fibrillation (NRAF) of an atrial appendage so that the formation blood clots within the atrial appendage is decreased or eliminated. In addition, the apparatus includes a blood clot filter supported by the atrial pacer proximate the atrial appendage and the atrium to reduce the migration of blood clots from the atrial appendage into the blood vessel system of a patient.

87 Claims, 4 Drawing Sheets



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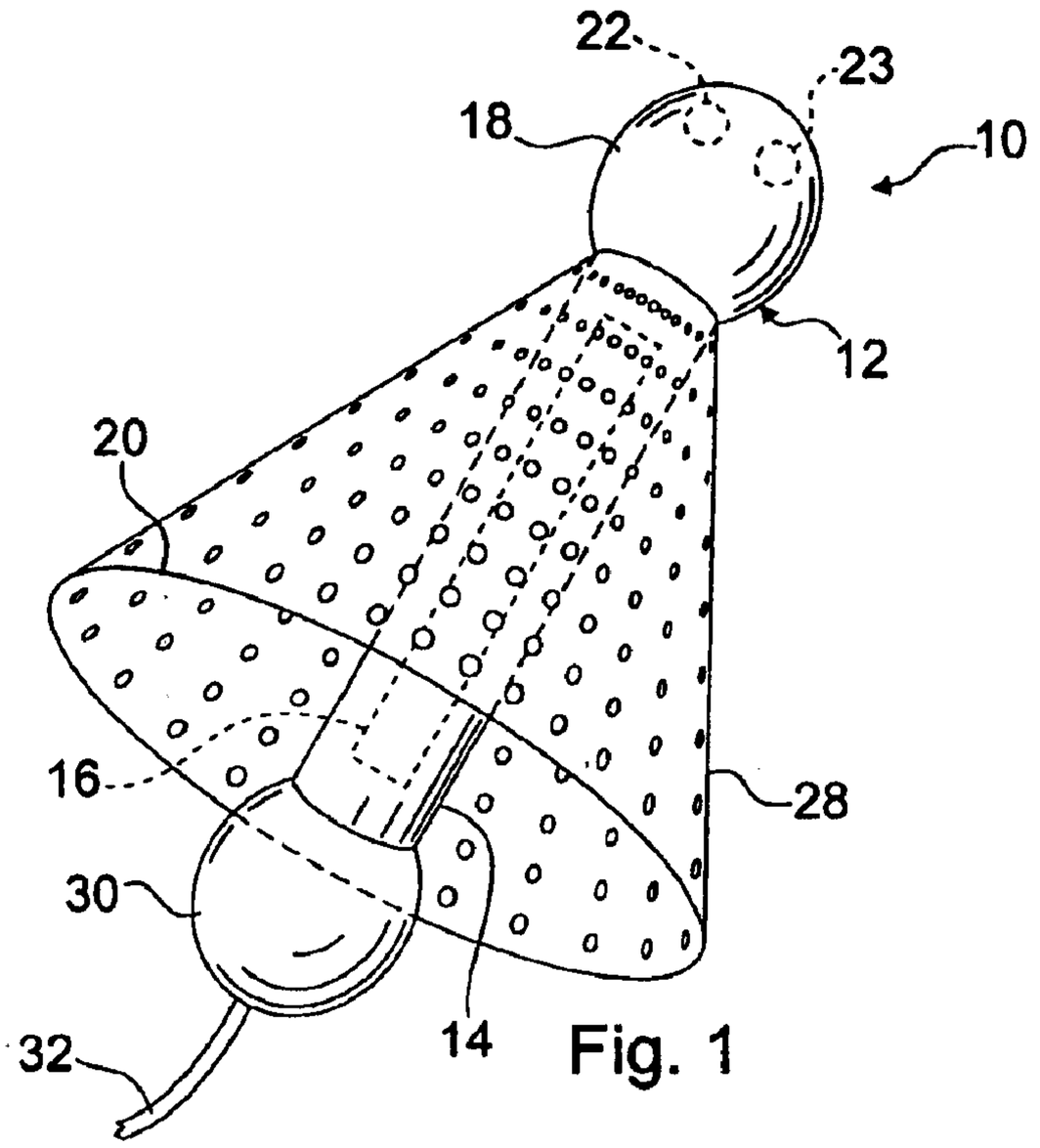
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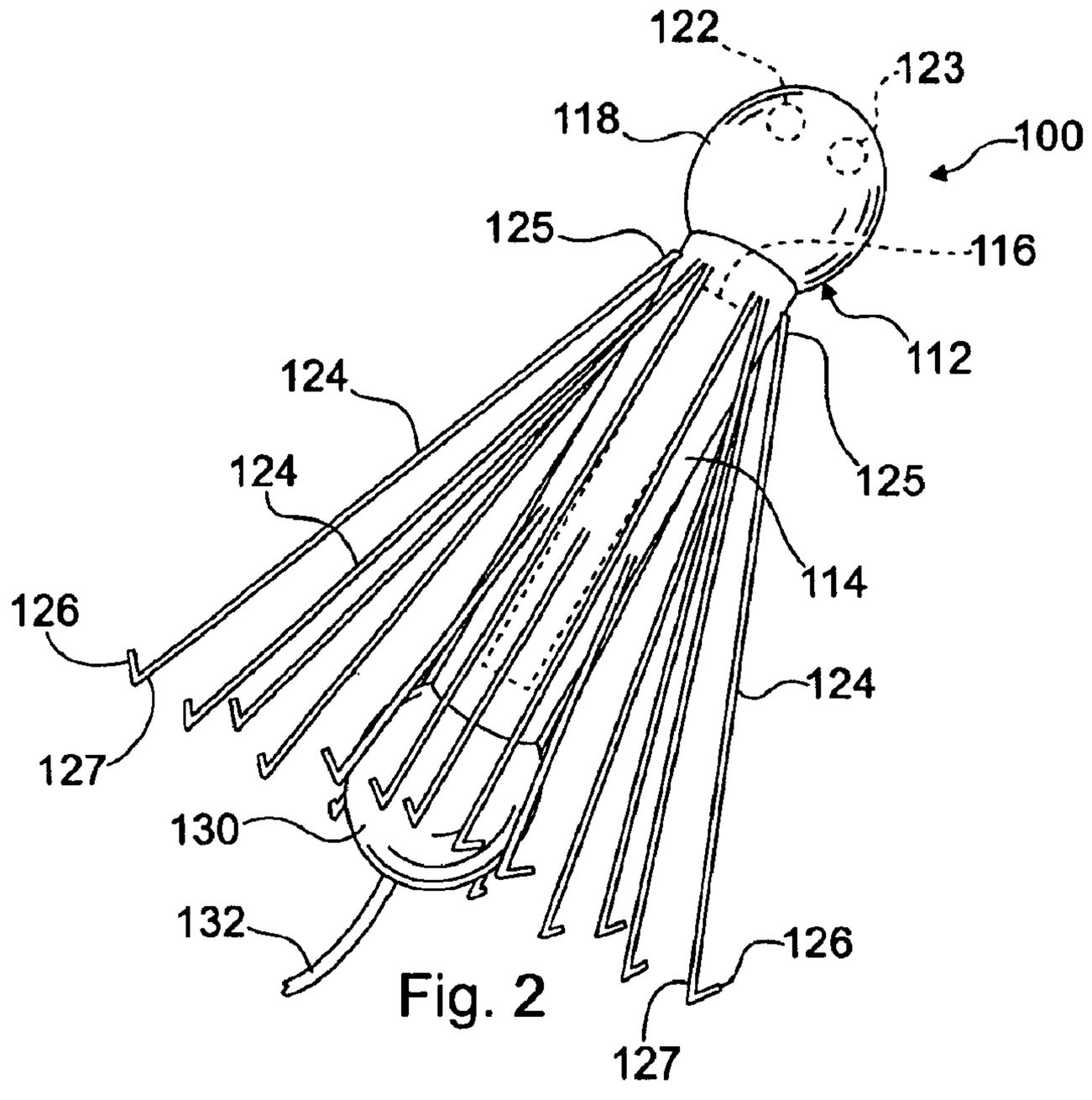
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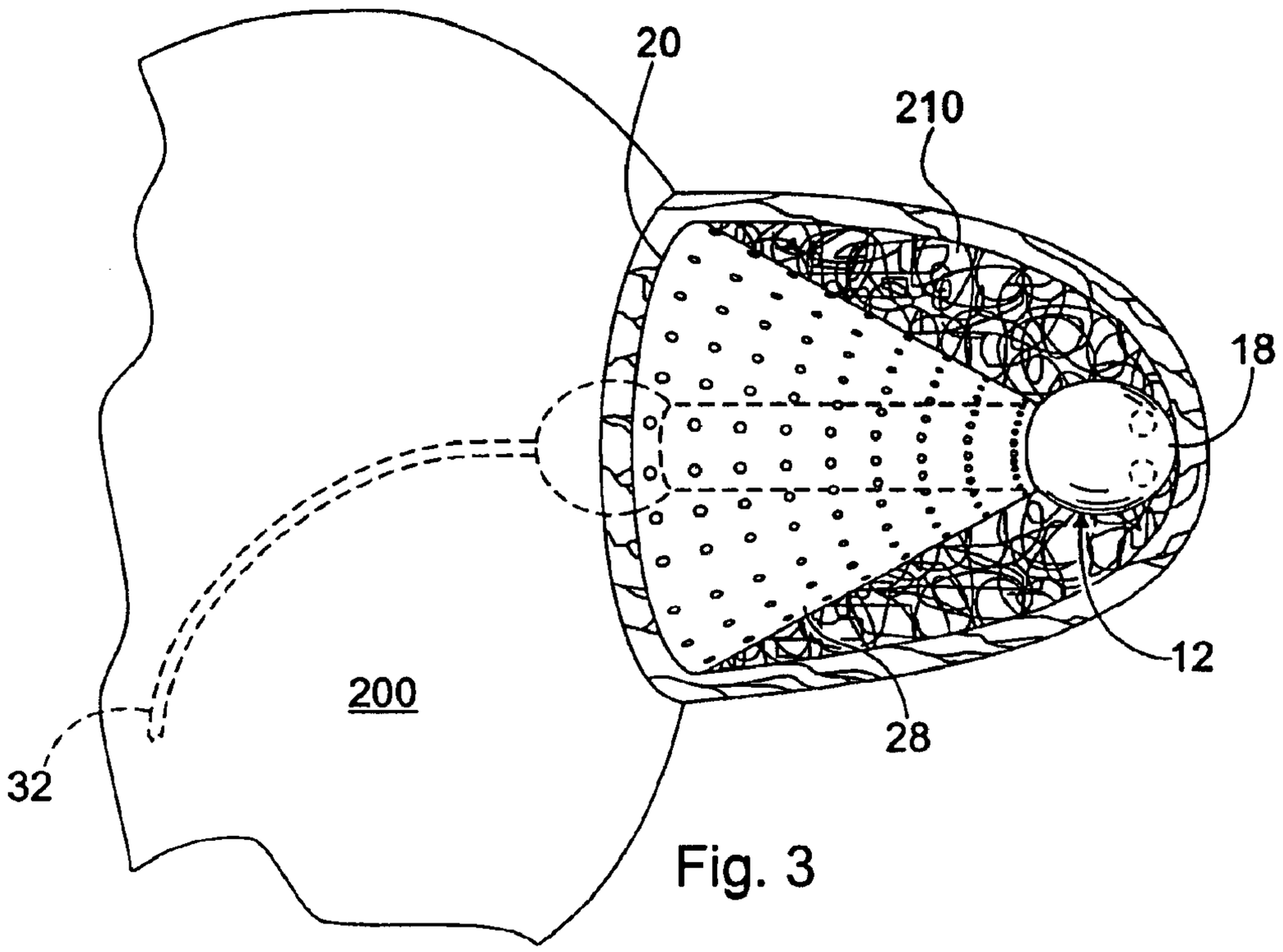

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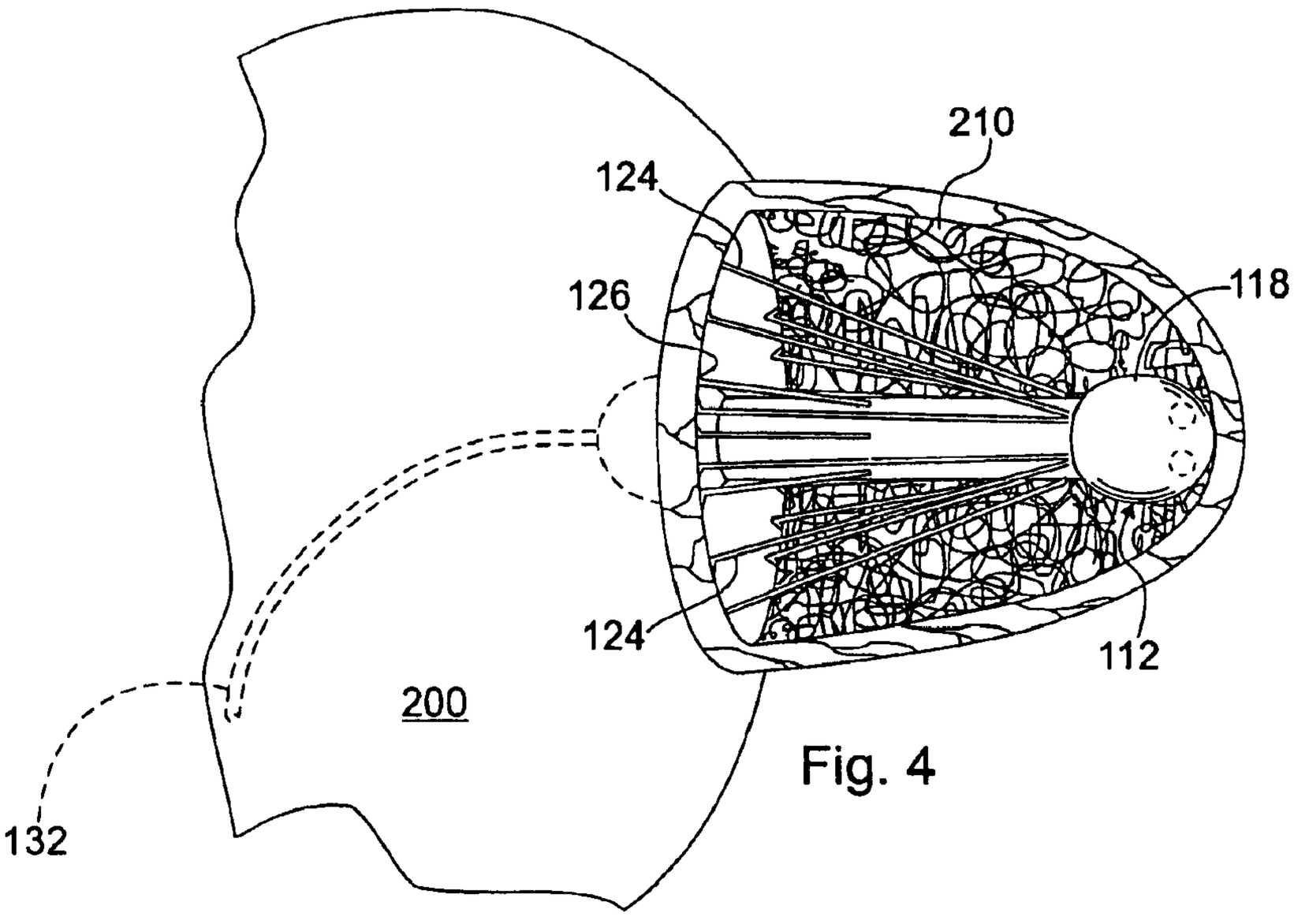

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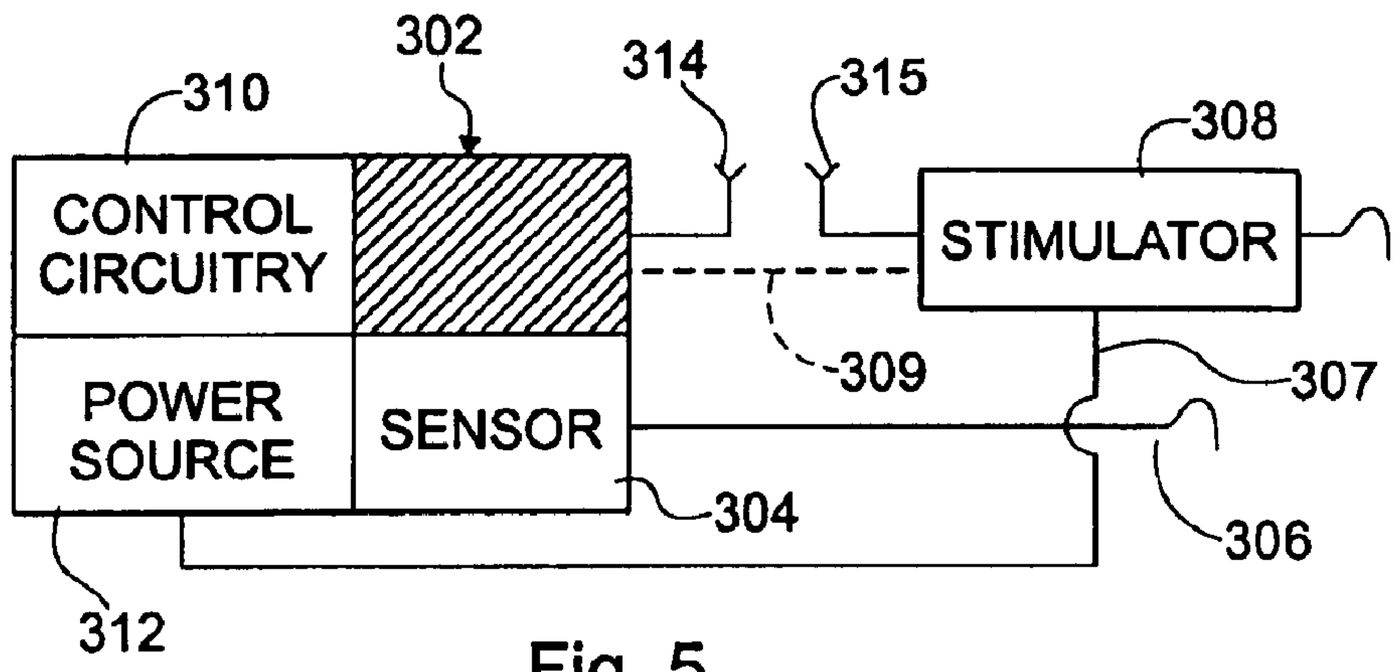

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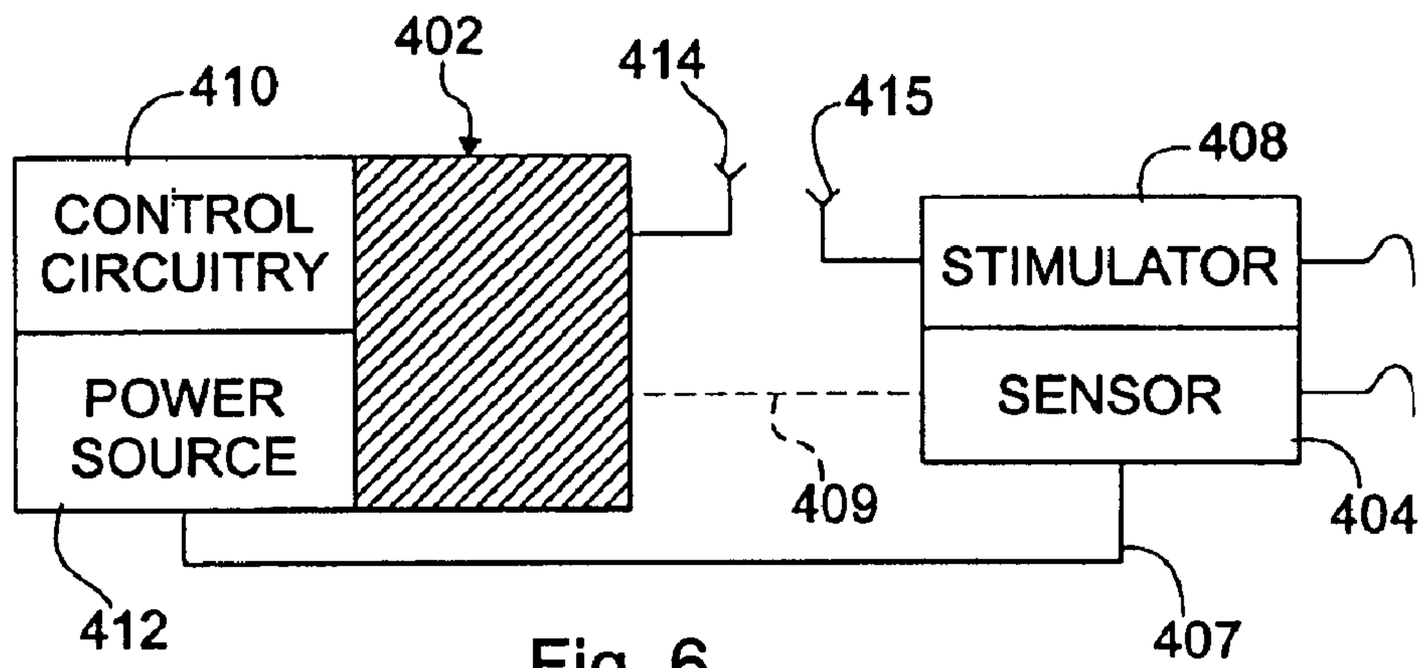

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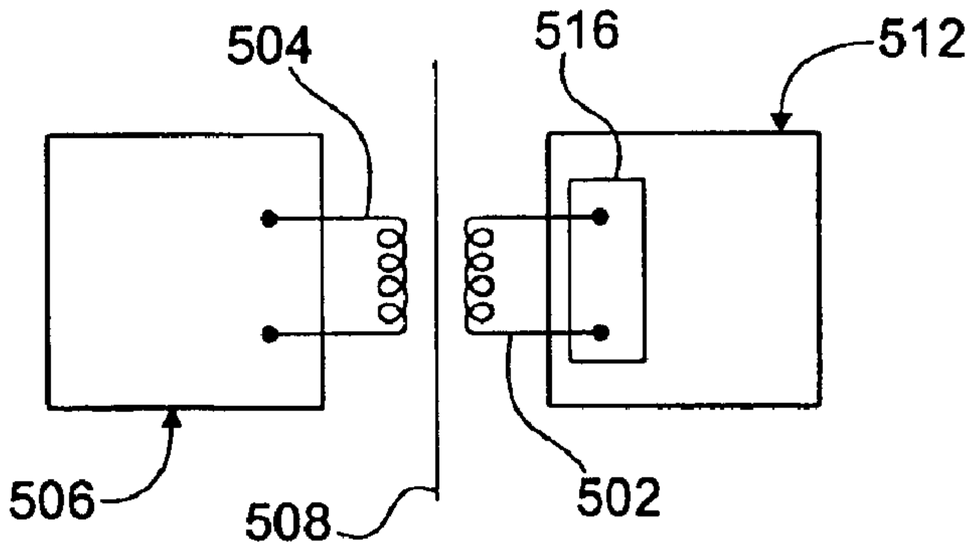

Fig. 7

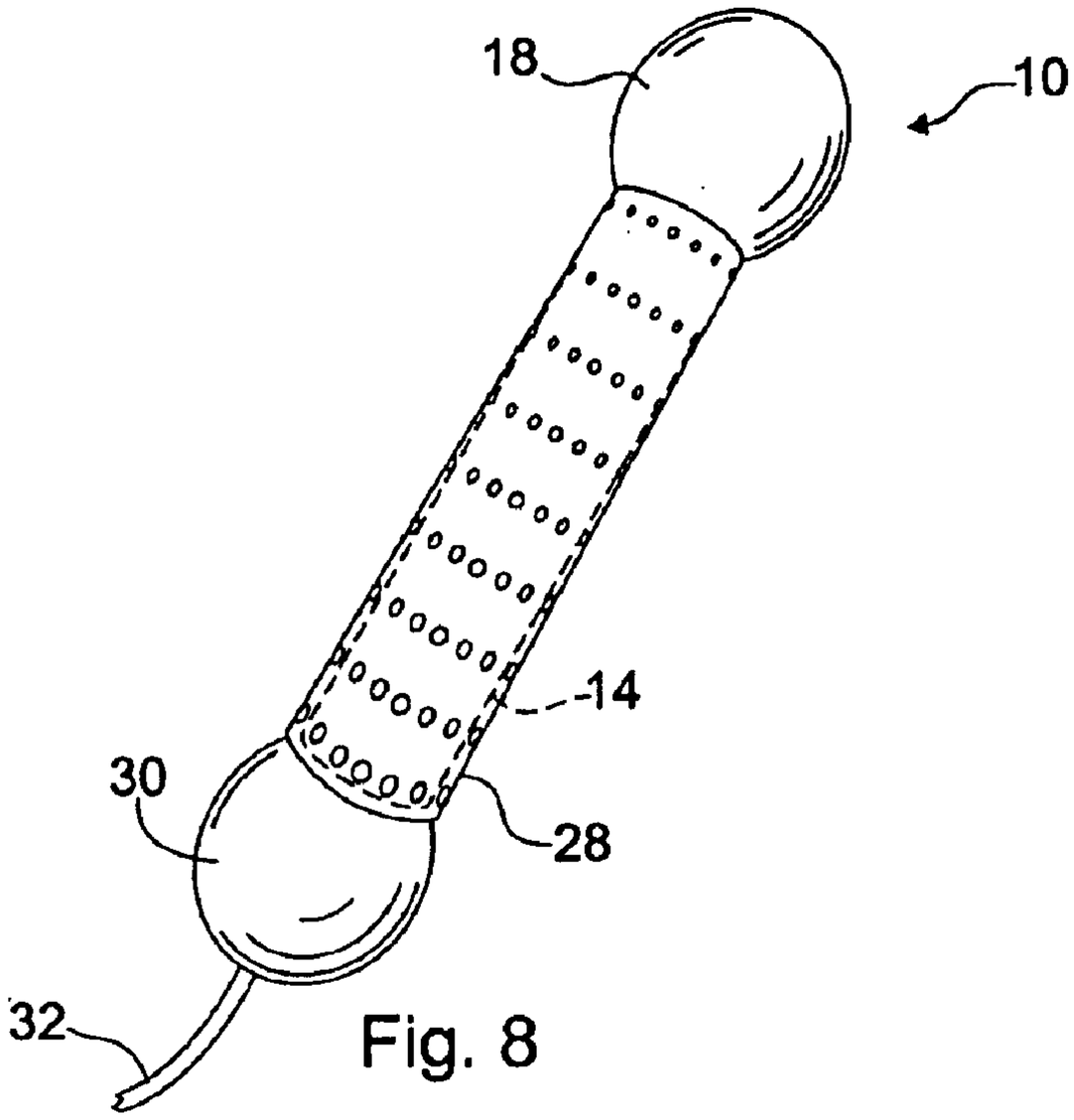

Fig. 8

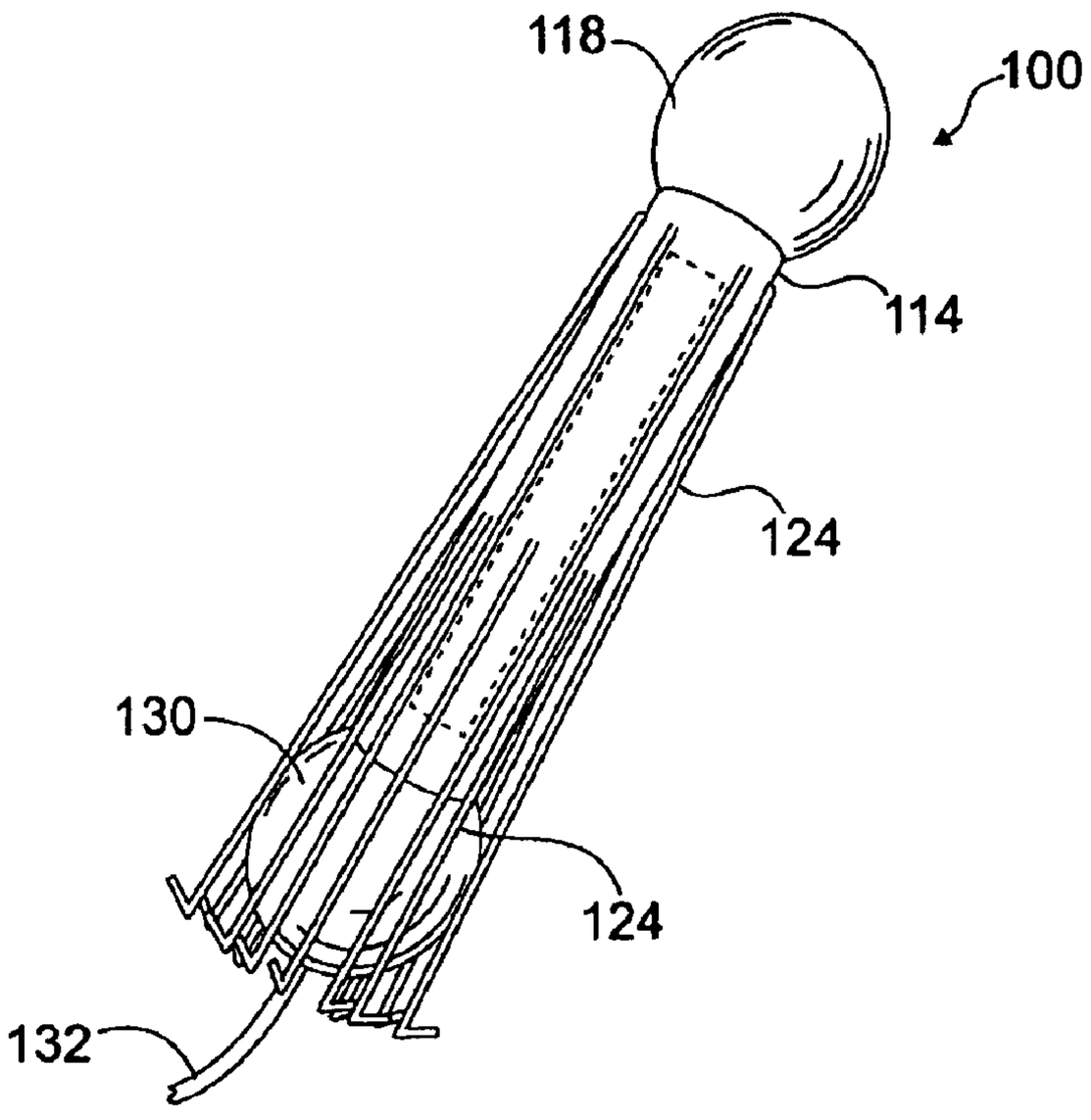

Fig. 9

CARDIAC STIMULATING APPARATUS HAVING A BLOOD CLOT FILTER AND ATRIAL PACER

CROSS-REFERENCE TO RELATED APPLICATIONS

This Application claims the benefit of U.S. Provisional Application 60/295,683, which was filed on Jun. 4, 2001.

FIELD OF THE INVENTION

The present invention relates generally to a device that deters migration of emboli from an atrial appendage into the vascular system of a patient, and more particularly to a device that includes a filter to deter such migration and a pacer to deter the formation of emboli such as blood clots within the atrial appendage.

BACKGROUND OF THE INVENTION

Non-rheumatic atrial fibrillation (NRAF) is associated with thromboembolic complications such as strokes. For example, when a thrombus or embolus occludes a vessel supplying blood to the brain, a stroke may result causing temporary or lasting paralysis of a part of the body or, in severe cases, death. Blockage of other blood vessels can occur as well causing attendant health concerns, including heart attack or gangrene. Presently, a five percent risk of stroke per year in a largely aging population causes NRAF to be a significant health concern. Given the potentially irreversible and destructive nature of such blood vessel occlusion, safe and effective methods are needed to eliminate embolic material like blood clots from the vascular system, some of which may be formed within an atrial appendage of the heart.

The left atrial appendage forms a small protrusion which is attached to the lateral wall of the left atrium between the mitral valve and the root of the left pulmonary vein and normally contracts along with the left atrium. Atrial fibrillation is a cardiac condition wherein the atria beat faster than the ventricles, causing the ventricles to contract irregularly and consequently eject less blood into the vascular system. A major problem associated with atrial fibrillation is pooling of blood in the left atrial appendage.

During NRAF the left atrial appendage may not fully contract, leaving stagnant blood within the left atrial appendage. In turn, the stagnant blood may create a condition favorable to the formation of blood clots within the left atrial appendage. Such clots may travel from the left atrial appendage into the left atrium and into the vascular system, thereby increasing the danger of stroke or cardiac blockage.

Traditional treatments to mitigate the risks posed by blood clots include the use of anticoagulants to dissolve the clots. For example, recently published results from stroke prevention trials suggest that prophylaxis with anticoagulation is beneficial to patients with non-rheumatic, non-valvular atrial fibrillation. Current therapeutic interventions include anticoagulation with coumedin. In addition, therapeutic interventions include the use of atrial rate regulating medications. However, both of these treatment approaches pose potential complications such as internal bleeding, as well as other negative side effects caused by the rate regulating therapeutic agents.

In addition to pharmacological treatments, complex radical surgical methods are available to treat atrial fibrillation. Such treatments include, for example, atrial incisions or removal of the left atrial appendage, which have been

attempted in a limited, experimental way. Such approaches are highly invasive and pose a risk of mortality to the patient. Thus, a pressing need exists for means by which the formation of blood clots the left atrial appendage is substantially deterred while preventing the migration of any blood clots which may form from entering the vascular system.

U.S. Pat. No. 6,152,144 to Lesh et al., for example, discloses a device and method for obliterating or occluding a body cavity or passageway. Specifically, the patent to Lesh is directed to a device and method for obliterating or occluding the left atrial appendage of a patient's heart. In one embodiment, Lesh et al. disclose a frame structure having a barrier or mesh material disposed over it to act as a barrier to the passage of embolic material.

However, Lesh et al. do not disclose a device or method suited to treat atrial fibrillation, or other arrhythmias of the heart, to thereby prevent the formation of clots in the left atrial appendage. As such, the barrier embodiment of Lesh et al. permits ongoing formation of clots within the left atrial appendage, which may eventually occlude the barrier material to prevent fluid flow as well as embolic material flow through the occluded barrier. Such a situation may present a health concern as the left atrial appendage contracts and the blood enclosed therein is unable to exit the left atrial appendage. Such contraction may result in an increased pressure in the left atrial appendage capable of weakening the wall of the left atrial appendage. Additionally, as the barrier embodiment of Lesh et al. does not prevent the formation of clots, it is possible that the volume of the left atrial appendage may eventually be filled with coagulated blood. Thus, filtering alone poses possible added health concerns.

Regarding the treatment of atrial fibrillation, it is known to use a pacemaker, for example, as disclosed in U.S. Pat. No. 6,178,351 B1 to Mower. Mower discloses a pacemaker that is capable of pacing the atria from multiple sites, but does not address prevention of migration of embolic material within the vascular system. Moreover, neither Mower nor Lesh suggests combining a pacer with an embolic barrier for use in the heart.

Accordingly, there is a need for an apparatus for mitigating the risks associated with emboli originating in the left atrial appendage and also for reducing the tendency of such emboli, such as blood clots, to form therein.

SUMMARY OF THE INVENTION

An apparatus is provided for deterring the formation and migration of blood clots from an atrial appendage, such as a left or right atrial appendage, into the blood vessel system, i.e. vascular system, of a patient. In particular, an apparatus of the present invention comprises an atrial pacer to treat non-rheumatic atrial fibrillation (NRAF) or other arrhythmias of an atrial appendage so that the formation of blood clots within such atrial appendage is decreased or eliminated. In addition, the apparatus provides a blood clot filter to deter the migration of blood clots from an atrial appendage into the blood vessel system of a patient.

More specifically, the apparatus comprises a filter for reducing the transport of emboli from an atrial appendage to an atrium of the heart. The filter is formed to provide a structure suitable for separating blood clots from the blood and for reducing passage of blood clots from the atrial appendage into the atrium and general circulation. In accordance with one aspect of the invention, the filter can take the form of a plurality of spokes extending outwardly from the atrial pacer. In another aspect, the filter can take the form of a mesh having pores sized to deter the passage of blood clots.

In accordance with another aspect of the invention, the apparatus comprises an atrial pacer which supports the filter between an atrial appendage and the atrium. The atrial pacer is adapted to be in contact with a wall of the atrial appendage so the atrial pacer may detect and reduce atrial fibrillation in the atrial appendage. The pacer also includes a sensor which may form an integral part of the atrial pacer for sensing fibrillation in the atrial appendage. In an alternative arrangement, the sensor may be adapted to be positioned externally to the heart. In this external arrangement, a lead wire may be provided between the sensor and the atrial wall, to provide sensing contact between the sensor and the atrial wall. The atrial pacer also comprises a stimulator for stimulating the atrial appendage. The simulator may take the form of an electrode for making electrical contact with the wall of the atrial appendage to apply stimulating signals to the atrial appendage. The stimulator may be activated in response to a signal from the sensor indicating the presence of NRAF, or other arrythmias, in the atrial appendage.

A control unit adapted to be positioned externally to the heart may optionally be provided for controlling the atrial pacer. The control unit may communicate with the sensor and/or the stimulator using a lead wire or wireless technology. In addition, the sensor may be disposed within the control unit. For example, in the arrangement where the sensor is positioned externally to the heart, the sensor may be incorporated within the control unit.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing summary and the following detailed description of the preferred embodiments of the present invention will be best understood when read in conjunction with the appended drawings, in which:

FIG. **1** is a schematic perspective view showing an exemplary device of the present invention having a mesh filter;

FIG. **2** is a schematic perspective view showing an exemplary device of the present invention having a filter which includes a plurality of spokes;

FIG. **3** is a schematic view of the exemplary device shown in FIG. **1** disposed within a left atrial appendage;

FIG. **4** is a schematic view of the exemplary device shown in FIG. **2** disposed within a left atrial appendage;

FIG. **5** is a schematic block diagram of a first exemplary configuration of an atrial pacer of the present invention having a control unit which includes a sensor and lead wire for detecting a selected condition of the heart;

FIG. **6** is a block diagram of a second exemplary configuration of an atrial pacer of the present invention having a control unit for communication with stimulator and sensor;

FIG. **7** is a block diagram of a rechargeable configuration of an atrial pacer of the present invention;

FIG. **8** is a schematic view of the exemplary device shown in FIG. **1** with the filter collapsed against the body of the device; and

FIG. **9** is a schematic view of the exemplary device shown in FIG. **2** with the spokes collapsed against the body of the device.

DETAILED DESCRIPTION OF THE INVENTION

A cardiac stimulating apparatus **10**, **100** is provided for substantially reducing the formation of blood clots in an atrial appendage of a heart, such as the left atrial appendage **210**, and reducing the migration of such clots into the blood vessel system of a patient. The apparatus **10**, **100** comprises a filtration device **28**, **124** to reduce migration of embolic material, such as blood clots or the like. In addition, the apparatus **10**, **100** includes an atrial pacer **12**, **112** to treat arrythmias, such as non-rheumatic atrial fibrillation (NRAF), of the left atrial appendage **210** to deter the formation blood clots within the left atrial appendage **210**. FIGS. **1–4** depict the general structure of a cardiac stimulating apparatus of the present invention, illustrating the cooperation between the atrial pacer **12**, **112** and the filtration device, such as filter **28** or spokes **124**.

Turning now to FIGS. **1** and **3**, an embodiment of the present invention is shown in which a cardiac stimulating apparatus **10** comprises an atrial pacer **12** having an elongated generally tubular body **14** having first and second opposing ends **18**, **30**. The first end **18** of the atrial pacer **12** is adapted to contact the wall of the left atrial appendage **210** to support the cardiac stimulating apparatus **10** within the left atrial appendage **210**. The first end **18** may include a sensing device **22** optionally disposed therein to detect NRAF or other arrhythmias in the left atrial appendage **210**. In such a configuration, the sensing device **22** is adapted to be in sensing contact with the wall of the left atrial appendage **210**. The first end **18** of the atrial pacer **12** also includes a stimulating device **23** for stimulating the left atrial appendage **210** in response to detection of NRAF by a detector, such as sensing device **22**. The stimulating device **23** includes an electrode adapted to be in electrical contact with the wall of the atrial appendage **210** for applying stimulating signals to the atrial appendage **210**. By application of an appropriate stimulating signal, NRAF can be reduced or eliminated thereby reducing the tendency of blood within the left atrial appendage **210** to form blood clots. The sensing device **22** and stimulating device **23** may comprise components known for use in atrial pacers.

Extending outwardly from the elongated generally tubular body **14**, a filtration device is provided to deter the migration of blood clots from the left atrial appendage **210** into the left atrium **200** of the heart. As shown in FIG. **1**, an embodiment of the filtration device may take the form of a mesh-like or sieve-like filter **28**. The filter **28** may have a generally conical shape as shown, for example, with the narrower end of the conical filter **28** attached to the atrial pacer **12** proximate to the first end **18** of the atrial pacer **12**. Alternatively, the filter **28** may be attached to the atrial pacer **12** at any point along the elongated body **14**. The filter **28** may have any shape suited to substantially fill the opening defined by the intersection of the left atrial appendage **210** and the left atrium **200**, such as a portion of a sphere, flat sheet, or other shape.

The mesh-like material of the filter **28** may be formed from a metal, such as a stainless-steel, for example. Alternatively, the filter **28** may be formed from a polymeric material, such as a Nylon or Dacron mesh. Other suitable materials such as PTFE or polyamides may also be used. In particular, it is preferable that the filter **28** be formed of a resilient material capable of being collapsed about the body **14** of the atrial pacer **12**, as shown in FIG. **8**, to facilitate introduction of the cardiac stimulating device **10** into a patient, for example, via a catheter. The resilient material is chosen such that upon removal of the cardiac stimulating device **10** from the catheter, the filter **28** expands to a desired shape and size to permit the opening of the left atrial appendage **210** to be substantially sealed. Regardless of the material from which the filter **28** is formed, the filter **28** is formed to provide pores having a transverse dimensions of

about 1 mm or other size sufficiently small to prevent the passage of blood clots or other thromboembolic material of like or greater size. In particular, it may be desirable for the pore size to have a transverse dimension up to about 0.1 mm.

The wider end of the filter **28** includes a rim portion **20** which defines the is base of the filter **28**. The rim portion **20** is sized to circumscribe the opening between the left atrial appendage **210** and left atrium **200**, so that emplacement the cardiac stimulating device **10** in the left atrial appendage **210** generally positions the rim portion **20** near the opening left atrial appendage **210** so as to form and maintain a seal therewith. To effect and maintain such a seal, the rim portion **20** may be formed of or covered by a soft polymer material. The rim portion **20** may have a transverse dimension of about 2 to 40 mm, preferably about 25 to 35 mm. The transverse dimension of the rim portion **20** should be selected with regard to the size of the left atrial appendage opening, which may vary among patients, especially those patients having heart disease related conditions.

The rim portion **20** may also include a plurality of holes through which sutures may be placed to anchor the rim portion **20** proximate to the opening of the left atrial appendage **210**. Alternatively or additionally, the rim portion **20** may have a spring-like action which causes the rim portion **20** to expand generally radially outward from the longitudinal axis of the atrial pacer **12**, so that the rim portion **20** applies pressure against a region proximate the opening of the left atrial appendage **210** to form a seal proximate the opening of the left atrial appendage **210**. For example, the rim portion **20** may be formed of a shape memory metal, such as NiTi, having a memorized shape larger than that of the opening of the left atrial appendage **210** to supply the radially outward pressure on the opening. The filter **28** is attached to the atrial pacer **12** at such a location so as to permit the rim portion **20** to substantially form a seal within the left atrial appendage opening and to permit the first end **18** of the atrial pacer **12** to contact the wall of the atrial appendage **210**.

Referring now to FIGS. **2** and **4**, an alternative embodiment of the cardiac stimulating apparatus **100** is shown where the filtration device comprises a plurality of spokes **124** extending generally radially outwardly from the atrial pacer **112**, to deter the migration of blood clots from the left atrial appendage **210** of the heart to the left atrium **200** of the heart. The atrial pacer **112** of the alternative embodiment comprises an elongated generally tubular body **114** having first and second ends **118**, **130**, a stimulating device **123**, and an optional sensing device **122** similar to like components **23** and **22** described above with regard to the previous embodiment.

The spokes **124** each comprise a first end **125** attached to the elongated body **114** of the atrial pacer **112** and a second end **127** of the spokes **124** for engaging a region of the heart in the vicinity of the left atrial appendage **210**. The second end **127** of the spokes **124** may terminate in a hook-like tine **126** formed to anchor the spokes **124** and retain the atrial pacer **112** within the left atrial appendage **210**. In addition, all or some of the second ends **127** of the spokes **124** may include a hole suitable for placing a suture therethrough for attachment to the left atrial appendage **210**. The number of spokes **124** employed should be sufficiently numerous to create interstices between the spokes **124** sufficiently small to deter the passage of embolic material through the interstices.

The first ends **125** of the plurality a spokes **124** may be attached to the body **114** of the atrial pacer **112** at a common distance from the first end **118** of the atrial pacer **112**. Alternatively, the first ends **125** of the plurality of spokes **124** may be attached to the body **114** of the atrial pacer **112** at varying distances from the first end **118** of the atrial pacer **112**. Providing spokes **124** at a variety of distances from the first end **118** of the atrial pacer **112** may be useful to create a tortuous path to deter the flow of embolic material. For example, a first set of spokes **124** may have first ends **125** adjoining the atrial pacer **112** at a common distance from the first end **118** around the circumference of the atrial pacer **112**. A second set of spokes may have first ends adjoining the atrial pacer **112** at a further distance from the first end **118** of the atrial pacer **112** than the first set of spokes **124**. In addition, the second set of spokes may be oriented circumferentially to overlap with the interstices formed among the first set of spokes **124**, as viewed from the first end **118** of the atrial pacer **112**. Likewise, additional set of spokes **124** may be included to effect additional blockage of embolic material flow. Moreover, some or all of the spokes **124** may extend outwardly from the atrial pacer **112** along non-radial directions, to enhance blockage of embolic material.

The spokes **124** may be formed of any suitable material such as a metal or polymeric material like those described above with regard to the mesh-like filter **28**. It is also desirable that the spokes **124** be sufficiently pliable to permit the spokes **124** to be disposed along the body **114** of the atrial pacer **112**, as shown in FIG. **9**, while the cardiac stimulating device **100** is placed into a patient via a catheter.

In addition, it is desirable that the spokes **124** be sufficiently resilient so that they expand away from the body **114** of the atrial pacer **112** once removed from the catheter, permitting the spokes **124** to engage the wall of left atrial appendage **210**. In addition, the spokes **124** are formed sufficiently long and disposed at an angle away from the body **114** of the atrial pacer **112** to cause the second ends **127** of the spokes **124** to be biased against the wall of the left atrial appendage **210** to retain the cardiac stimulating device **100** in position. For example, the spokes **125** may have a length to allow the second ends **127** of the spokes **124** to terminate proximate the left atrial appendage opening. The spokes **124** are attached to the atrial pacer **112** at such a location as to permit the spokes **124** to partially occlude the opening of the left atrial appendage and to permit the first end **118** of the atrial pacer **112** to contact the wall of the atrial appendage **210**.

In each of the above embodiments, the atrial pacer **12**, **112** may include a power source **16**, **116**, such as a rechargeable battery, within the generally elongated body **14**, **114** along with appropriate circuitry known for the operation of atrial sensing and stimulating devices. Alternatively or additionally, the cardiac stimulating device **10**, **100** may include a lead wire **32**, **132** to provide power and/or a control signal to the atrial pacer **12**, **112** from a remote device. A control unit for use external to the left atrial appendage **210**, or external to a patient's body, may be provided for housing circuitry of the atrial pacer **12**, **112**. Providing such a control unit may also be desirable, since inclusion of control circuitry therein may permit the atrial pacer **12**, **112** to have a smaller overall the size.

Referring to FIGS. **5–7**, three exemplary embodiments are shown of device arrangements which include remote control and/or power supply units. In particular, with regard to FIG. **5**, a control unit **302** is shown for controlling and powering the stimulator **308** of an atrial pacer. The stimulator **308** may correspond to the stimulating devices **23**, **123** depicted in FIGS. **1** and **2** as described above. In the configuration of FIG. **5**, a sensor **304** is incorporated in a remotely located

control unit **302** rather than in the elongated body **14**, **114** of the atrial pacer **12**, **112**. The sensor **304** is in sensing contact with the left atrial appendage **210** via lead wire **306** to detect NRAF in the atrial appendage **210**. Hence, for this configuration the sensing device **22**, **122** described above as being disposed within the first end **18**, **118** of the atrial pacer **12**,**112** is not required to be disposed therein.

The control unit **302** further includes control circuitry **310** for processing the signal detected by the sensor **304** and controlling the stimulator **308** in response to the detected signal. For example, when the control circuitry **310** receives a signal from the sensor **304** indicative of NRAF of the left atrial appendage **210**, the control circuitry delivers a control signal to the stimulator **308** to cause the stimulator **308** to stimulate the left atrial appendage **210** to alleviate the NRAF. Hence, by correcting NRAF, formation of blood clots in the left atrial appendage **210** is reduced by limiting the presence of stagnant blood in the left atrial appendage **210**. The control unit **302** communicates with the stimulator **308** via an optional lead wire **309** or via wireless communication.

Wireless communication can be effected via optional antennas **314**, **315** connected to the control unit **302** and the stimulator **308**, respectively. The antenna **315** of the stimulator **308** may be disposed, for example, at the second end **30**, **130** of the atrial pacer **12**, **112**. The control unit **302** may include a power source **312** to power the control unit **302** and to optionally power the stimulator **308** via lead wire **307**.

Referring to FIG. **6**, a further embodiment of the present invention is shown which is substantially similar to that shown in FIG. **5**. The embodiment of FIG. **6** differs from FIG. **5** in that the control unit **402** of FIG. **6** does not include a sensor. Instead, a sensor **404** is provided in the elongated body **14**, **114** of the atrial pacer **12**, **112** along with a stimulator **408**. Such a sensor **404** may correspond to the sensing devices **22**, **122** shown in FIGS. **1** and **2** and described above. Since the sensor **404** and stimulator **408** are both disposed within the body **14**, **114** of the atrial pacer **12**, **112**, the sensor **404** and stimulator **408** may communicate directly with each other so that the stimulator **408** may stimulate left atrial appendage **210** in response to the detection of NRAF by the sensor **404**. Alternatively, to minimize the size of the atrial pacer, control circuitry may be provided in a remote control unit **402** to receive data from the sensor **404**, to process such data, and control the stimulator **408** in response to such data. Communication between the control unit **402** and the stimulator **408** and sensor **404** may be effected via an optional lead wire **409** or via wireless communication using optional antennas **414**, **415**, in a similar manner to that described above with regard to the embodiment of FIG. **5**.

In addition, as shown in FIG. **7**, the atrial pacer **512** may be configured to be recharged by a remote charger **506**. In such an embodiment, the atrial pacer **512** includes a first electrical coil **502** electrically coupled to an energizer unit **516**, such as a battery, of the atrial pacer **512**. The recharger **506** has a corresponding second electrical coil **504** which may be electromagnetically coupled to the first coil **502** to transmit electromagnetic energy thereto from the charger **506**, through the patient's skin **508**, and thence into the energizer unit **516** of the atrial pacer **512**.

After insertion of the cardiac stimulating device **10**, **100** into the heart so that the filtration device **28**, **126** expands and sensing device **22**, **122** or sensor **304**, **404** is placed in sensing contact with the left atrial appendage **210**, the cardiac stimulating device **10**, **100** monitors for the presence of NRAF. Upon detection of NRAF, the stimulator **23**, **123** applies a correcting stimulating electrical signal to the left atrial appendage **210** in response to the detected NRAF condition. By such treatment of the left atrial appendage **210** to minimize NRAF, the formation of blood clots attributable to NRAF is minimized. In addition, the presence of the filtration device **28**, **126** provides continuous filtration of the blood exiting the left atrial appendage **210**, so as to prevent the egress of emboli therefrom.

These and other advantages of the present invention will be apparent to those skilled in the art. Accordingly, it will be recognized by those skilled in the art that changes or modifications may be made to the above-described embodiments without departing from the broad inventive concepts of the invention. For example, the atrial pacer could be replaced and/or adapted to function as a ventricular defibrillator to treat ventricular tachycardia. Likewise, the atrial pacer could be replaced by a device that functions as a combined atrial pacer and ventricular defibrillator. It should therefore be understood that this invention is not limited to the particular embodiments described herein, but is intended to include all changes and modifications that are within the scope and spirit of the invention as set forth in the claims.

What is claimed is:

1. A cardiac stimulating apparatus, comprising:

a filter adapted to substantially prevent transport of emboli from an atrial

appendage to an atrium of the heart; and

an atrial pacer to support the filter between the atrial appendage and the atrium, the atrial pacer adapted to be in sensing contact with a wall of the atrial appendage to reduce atrial fibrillation in the atrial appendage.

2. The cardiac stimulating apparatus according to claim **1** wherein the filter comprises a plurality of spokes.

3. The cardiac stimulating apparatus according to claim **2** wherein the spokes include tines to attach the filter to the atrial appendage.

4. The cardiac stimulating apparatus according to claim **1** wherein the spokes extend generally radially outwardly from the atrial pacer.

5. The cardiac stimulating apparatus according to claim **1** wherein the filter comprises a mesh.

6. The cardiac stimulating apparatus according to claim **1** wherein the filter includes at least one of an expandable mesh and a plurality of expandable spokes.

7. The cardiac stimulating apparatus according to claim **6** wherein said one of said expendable mesh and said plurality of expendable spokes are collapsible to be disposed near the atrial pacer for implantation into the atrial appendage through a catheter.

8. The cardiac stimulating apparatus according to claim **1** wherein atrial pacer includes a control unit adapted to be disposed external to the heart.

9. The cardiac stimulating apparatus according to claim **8** wherein, the control unit includes a sensor adapted to be in sensing contact with the wall of the atrial appendage.

10. The cardiac stimulating apparatus according to claim **9** wherein the control unit is adapted to be in wireless communication with the sensor.

11. The cardiac stimulating apparatus according to claim **8** wherein the control unit comprises circuitry for providing a control signal to control the atrial pacer.

12. The cardiac stimulating apparatus according to claim **8** wherein the atrial pacer includes a stimulator adapted to be disposed interior to the heart for applying a stimulating signal to the wall of the atrial appendage.

13. The cardiac stimulating apparatus according to claim **12** wherein the control unit is adapted to be in wireless communication with the stimulator.

14. The cardiac stimulating apparatus according to claim 12 wherein the control unit is adapted to be in wireless communication with the electrode.

15. The cardiac stimulating apparatus according to claim 1 wherein the atrial pacer includes at least one of a stimulator disposed therein for applying a stimulating signal to the wall of the atrial appendage and a sensor disposed therein to be in sensing contact with a wall of the atrial appendage.

16. The cardiac stimulating apparatus according to claim 1 comprising:

i) a charger adapted to be disposed external to a patient's body for providing a power signal in the form of electromagnetic energy; and

ii) an energizer adapted to be disposed internal to a patient's body for receiving the power signal provided by the generator unit to energize said atrial pacer.

17. The cardiac stimulating apparatus according to claim 16 wherein the charger and the energizer are in wireless communication.

18. The cardiac stimulating apparatus according to claim 16 wherein the generator unit comprises a first coil for transmitting the power signal and the energizing unit comprises a second coil for receiving the power signal.

19. A cardiac stimulating apparatus, comprising:

a filter adapted to engage proximate an opening between an atrial appendage and an atrium of a heart; and

an atrial pacer to support the filter proximate the opening between the atrial appendage and the atrium, comprising

i) a sensor adapted to be in sensing contact with a wall of the atrial appendage for sensing fibrillation of the atrial appendage, and

ii) an electrode adapted to be in electrical contact with the wall of the atrial appendage for applying stimulating signals to the atrial appendage.

20. The cardiac stimulating apparatus according to claim 19 wherein the filter comprises a plurality of spokes.

21. The cardiac stimulating apparatus according to claim 20 wherein the spokes include tines to attach the filter to the atrial appendage.

22. The cardiac stimulating apparatus according to claim 19 wherein the spokes extend generally radially outwardly from the atrial pacer.

23. The cardiac stimulating apparatus according to claim 19 wherein the filter comprises a mesh.

24. The cardiac stimulating apparatus according to claim 19 wherein the filter includes at least one of an expandable mesh and a plurality of expandable spokes.

25. The cardiac stimulating apparatus according to claim 24 wherein said one of said expendable mesh and said plurality of expendable spokes are collapsible to be disposed near the atrial pacer for implantation into the atrial appendage through a catheter.

26. The cardiac stimulating apparatus according to claim 19 wherein atrial pacer includes a control unit adapted to be disposed external to the heart.

27. The cardiac stimulating apparatus according to claim 26 wherein the control unit is adapted to be in wireless communication with the sensor.

28. The cardiac stimulating apparatus according to claim 26 wherein the control unit comprises circuitry for providing a control signal to control the atrial pacer.

29. The cardiac stimulating apparatus according to claim 19 wherein the atrial pacer includes a stimulator for providing a stimulation control signal to the electrode.

30. The cardiac stimulating apparatus according to claim 19 comprising:

i) a charger adapted to be disposed external to a patient's body for providing a power signal in the form of electromagnetic energy; and

ii) an energizer adapted to be disposed internal to a patient's body for receiving the power signal provided by the generator unit to energize said atrial pacer.

31. The cardiac stimulating apparatus according to claim 30 wherein the generator unit comprises a first coil for transmitting the power signal and the energizing unit comprises a second coil for receiving the power signal.

32. A cardiac stimulating apparatus, comprising:

a filtration device for reducing the transport of emboli from an atrial appendage to an atrium of the heart; and

an atrial pacer to support the filtration device between the atrial appendage and the atrium, the atrial pacer adapted to contact a wall of the atrial appendage for reducing atrial fibrillation in the atrial appendage.

33. The cardiac stimulating apparatus according to claim 32 wherein the filtration device comprises a plurality of spokes.

34. The cardiac stimulating apparatus according to claim 33 wherein the spokes include tines to attach the filtration device to the atrial appendage.

35. The cardiac stimulating apparatus according to claim 32 wherein the spokes extend generally radially outwardly from the atrial pacer.

36. The cardiac stimulating apparatus according to claim 32 wherein the filtration device comprises a mesh.

37. The cardiac stimulating apparatus according to claim 32 wherein the filtration device includes at least one of an expandable mesh and a plurality of expandable spokes.

38. The cardiac stimulating apparatus according to claim 37 wherein said one of said expendable mesh and said plurality of expendable spokes are collapsible to be disposed near the atrial pacer for implantation into the atrial appendage through a catheter.

39. The cardiac stimulating apparatus according to claim 32 wherein atrial pacer includes a control unit adapted to be disposed external to the heart.

40. The cardiac stimulating apparatus according to claim 39 wherein, the control unit includes a sensor adapted to be in sensing contact with the wall of the atrial appendage.

41. The cardiac stimulating apparatus according to claim 40 wherein the control unit is adapted to be in wireless communication with the sensor.

42. The cardiac stimulating apparatus according to claim 39 wherein the control unit comprises circuitry for providing a control signal to control the atrial pacer.

43. The cardiac stimulating apparatus according to claim 39 wherein the atrial pacer includes a stimulator adapted to be disposed interior to the heart for applying a stimulating signal to the wall of the atrial appendage.

44. The cardiac stimulating apparatus according to claim 43 wherein the control unit is adapted to be in wireless communication with the stimulator.

45. The cardiac stimulating apparatus according to claim 32 wherein the atrial pacer includes at least one of a stimulator disposed therein for applying a stimulating signal to the wall of the atrial appendage and a sensor disposed therein to be in sensing contact with a wall of the atrial appendage.

46. The cardiac stimulating apparatus according to claim 32 comprising:

i) a charger adapted to be disposed external to a patient's body for providing a power signal in the form of electromagnetic energy; and

ii) an energizer adapted to be disposed internal to a patient's body for receiving the power signal provided by the generator unit to energize said atrial pacer.

47. The cardiac stimulating apparatus according to claim **46** wherein the generator unit comprises a first coil for transmitting the power signal and the energizing unit comprises a second coil for receiving the power signal.

48. A cardiac stimulating apparatus comprising:

an atrial pacer comprising an elongated body adapted at one end thereof for making at least one of sensing and stimulating contact with a wall of an atrial appendage of a heart, said atrial pacer including at least one of an atrial sensor and an atrial stimulator; and

an filtration device mounted to said elongated body distal the one end thereof and adapted for intercepting emboli moving between the atrial appendage and an atrium of the heart.

49. The cardiac stimulating apparatus according to claim **48** wherein the filtration device comprises a plurality of spokes.

50. The cardiac stimulating apparatus according to claim **49** wherein the spokes include tines to attach the filtration device to the atrial appendage.

51. The cardiac stimulating apparatus according to claim **48** wherein the spokes extend generally radially outwardly from the atrial pacer.

52. The cardiac stimulating apparatus according to claim **48** wherein the filtration device comprises a mesh.

53. The cardiac stimulating apparatus according to claim **48** wherein the filtration device includes at least one of an expandable mesh and a plurality of expandable spokes.

54. The cardiac stimulating apparatus according to claim **53** wherein said one of said expendable mesh and said plurality of expendable spokes are collapsible to be disposed near the atrial pacer for implantation into the atrial appendage through a catheter.

55. The cardiac stimulating apparatus according to claim **48** wherein atrial pacer includes a control unit adapted to be disposed external to the heart.

56. The cardiac stimulating apparatus according to claim **55** wherein the control unit is adapted to be in wireless communication with the atrial sensor.

57. The cardiac stimulating apparatus according to claim **55** wherein the control unit is adapted to be in wireless communication with the stimulator.

58. The cardiac stimulating apparatus according to claim **48** wherein the stimulator is adapted to apply a stimulating signal to the wall of the atrial appendage and the sensor is adapted to be in sensing contact with a wall of the atrial appendage.

59. The cardiac stimulating apparatus according to claim **48** comprising:

i) a charger adapted to be disposed external to a patient's body for providing a power signal in the form of electromagnetic energy; and

ii) an energizer adapted to be disposed internal to a patient's body for receiving the power signal provided by the generator unit to energize said atrial pacer.

60. The cardiac stimulating apparatus according to claim **59** wherein the generator unit comprises a first coil for transmitting the power signal and the energizing unit comprises a second coil for receiving the power signal.

61. A cardiac stimulating apparatus comprising:

an atrial pacer comprising an elongated body adapted at one end thereof for making at least one of sensing and stimulating contact with a wall of an atrial appendage of a heart, said atrial pacer including an atrial sensor and an atrial stimulator disposed in said elongated body; and

an filtration device mounted to said elongated body distal the one end thereof and adapted for intercepting emboli moving between the atrial appendage and an atrium of the heart.

62. The cardiac stimulating apparatus according to claim **61** wherein the filtration device comprises a plurality of spokes.

63. The cardiac stimulating apparatus according to claim **62** wherein the spokes include tines to attach the filtration device to the atrial appendage.

64. The cardiac stimulating apparatus according to claim **61** wherein the spokes extend generally radially outwardly from the atrial pacer.

65. The cardiac stimulating apparatus according to claim **61** wherein the filtration device comprises a mesh.

66. The cardiac stimulating apparatus according to claim **61** wherein the filtration device includes at least one of an expandable mesh and a plurality of expandable spokes.

67. The cardiac stimulating apparatus according to claim **66** wherein said one of said expendable mesh and said plurality of expendable spokes are collapsible to be disposed near the atrial pacer for implantation into the atrial appendage through a catheter.

68. The cardiac stimulating apparatus according to claim **61** wherein the atrial pacer includes a control unit adapted to be disposed external to the heart.

69. The cardiac stimulating apparatus according to claim **68** wherein the control unit is adapted to be in wireless communication with the sensor.

70. The cardiac stimulating apparatus according to claim **68** wherein the control unit is adapted to be in wireless communication with the stimulator.

71. The cardiac stimulating apparatus according to claim **61** wherein the stimulator is adapted to apply a stimulating signal to the wall of the atrial appendage and the sensor is adapted to be in sensing contact with a wall of the atrial appendage.

72. The cardiac stimulating apparatus according to claim **61** comprising:

i) a charger adapted to be disposed external to a patient's body for providing a power signal in the form of electromagnetic energy; and

ii) an energizer adapted to be disposed internal to a patient's body for receiving the power signal provided by the generator unit to energize said atrial pacer.

73. The cardiac stimulating apparatus according to claim **72** wherein the generator unit comprises a first coil for transmitting the power signal and the energizing unit comprises a second coil for receiving the power signal.

74. A cardiac stimulating apparatus, comprising:

a filtration means for reducing the transport of emboli from an atrial appendage to an atrium of the heart; and

a pacing means for supporting the filtration device between the atrial appendage and the atrium and for reducing atrial fibrillation in the atrial appendage.

75. The cardiac stimulating apparatus according to claim **74** wherein the filtration means comprises a plurality of spokes.

76. The cardiac stimulating apparatus according to claim **74** wherein the spokes extend generally radially outwardly from the pacing means.

77. The cardiac stimulating apparatus according to claim 74 wherein the filtration means comprises a mesh.

78. The cardiac stimulating apparatus according to claim 74 wherein the filtration means includes at least one of an expandable mesh and a plurality of expandable spokes.

79. The cardiac stimulating apparatus according to claim 78 wherein said one of said expendable mesh and said plurality of expendable spokes are collapsible to be disposed near the pacing means for implantation into the atrial appendage through a catheter.

80. The cardiac stimulating apparatus according to claim 74 wherein pacing means includes a control unit adapted to be disposed external to the heart.

81. The cardiac stimulating apparatus according to claim 80 wherein, the control unit includes a sensor adapted to be in sensing contact with the wall of the atrial appendage.

82. The cardiac stimulating apparatus according to claim 81 wherein the control unit is adapted to be in wireless communication with the sensor.

83. The cardiac stimulating apparatus according to claim 80 wherein the pacing means includes a stimulator adapted to be disposed interior to the heart for applying a stimulating signal to the wall of the atrial appendage.

84. The cardiac stimulating apparatus according to claim 83 wherein the control unit is adapted to be in wireless communication with the stimulator.

85. The cardiac stimulating apparatus according to claim 74 wherein the pacing means includes at least one of a stimulator disposed therein for applying a stimulating signal to the wall of the atrial appendage and a sensor disposed therein to be in sensing contact with a wall of the atrial appendage.

86. The cardiac stimulating apparatus according to claim 74 comprising:

i) a charger adapted to be disposed external to a patient's body for providing a power signal in the form of electromagnetic energy; and

ii) an energizer adapted to be disposed internal to a patient's body for receiving the power signal provided by the generator unit to energize said pacing means.

87. The cardiac stimulating apparatus according to claim 86 wherein the generator unit comprises a first coil for transmitting the power signal and the energizing unit comprises a second coil for receiving the power signal.

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